OFFICIAL COPY.

Dr. G. S. Buchanan's Report upon Epidemic Enteric Fever in the Urban District of Hucknall Torkard, and upon Sanitary Administration by the District Council.

R. Thorne Thorne,
Medical Officer,
February 1st, 1897.

On August 4th, 1896, the Board was informed by the Medical Officer of Health of the Urban District of Hucknall Torkard that enteric fever was prevalent in his district, and later, on August 29th, they received, through the Registrar-General, a report from the Registrar of the Bulwell sub-district which stated that ten deaths from enteric fever in Hucknall Torkard had been registered from July 10th to August 26th. As the Board had not received, by September 16th, the detailed information on the subject which they had asked the District Council to supply, I was directed to make local inquiry into the circumstances attending the fever prevalence.

Accordingly, I visited Hucknall Torkard on September 18th, and certain following days, and again in the middle of October.

I.—GENERAL DESCRIPTION.

The character of the district was described two years ago by Dr. Horne in his report to the Board on scarlatina prevalence in Hucknall Torkard and on Administration by the Sanitary Authority. I may quote his description here :—

"The Hucknall Torkard Urban Sanitary District, a portion of the Regis-
"tration sub-district of Bulwell, is situated in North Notts, about seven miles
"north-west from Nottingham, and eight miles south from Mansfield. It
"extends from east to west about three, and from north to south about two,
"miles. Its area is 3,270 acres. At the census of 1891 its population was
"13,094 persons, but during the last three years the number has been much
"augmented." The Medical Officer of Health estimates the number of inhabitants in 1896 as quite 15,000. "It is computed that 6,000 men and boys
"are engaged in coal mining; two thirds of them working at pits just
"beyond the Urban Sanitary District, while the remaining 2,000 are
"employed at two pits within the district itself. Besides the coal industry,
"there are hosiery factories, in which about 300, and a cigar manufactory,
"in which perhaps 200 hands, mainly girls, are employed. The physical
"aspect of the country is undulating, and the subsoil throughout is magnesian
"limestone."

A Local Board, constituted in 1867, was the Sanitary Authority of the district until 1894, when its functions were transferred to the Hucknall

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Torkard Urban District Council. The rateable value of the district is 34,173*l.*, the value assessable for the general district rate being 27,141*l.* Opinion in Hucknall Torkard favours a project for the inclusion within the boundaries of the urban district of the outside collieries which Dr. Horne has described as being served mainly by men who live within the town. These collieries, it is contended, should contribute rates rather to the urban than to the rural district.

Dwellings.—As Dr. Horne indicates, Hucknall Torkard is essentially a town of small houses, inhabited mainly by coal miners and artizans. The older part of the town chiefly consists of houses facing, or built in short streets which lead out of, the Nottingham to Mansfield Road, which runs from south-east to north-west through the district, forming the High Street. In addition, there are three considerable groups of older streets, one at the end of Watnall Road, which leads out of the centre of High Street to the south; one at the north-west end of High Street towards Linby Colliery; and a third at Butlers Hill at the south-east corner of the district. Of recent years much new building has taken place in all parts of the town. Several of the older streets have been continued and new streets have been built near them. Here and there, as in the neighbourhood of the Midland Station, groups of streets are met with which are composed entirely of new houses.

The majority of the older houses are two storied and four-roomed. A few are constructed of red sandstone and mortar, but most are built of brick. Many are damp. In some dwellings the only inside drain is a pipe leading to the outside from a sink in the kitchen or in an outbuilding, and discharging over a gully in the yard, or over an open brick gutter which takes waste water to a neighbouring gully and so to the sewer. In other cases there are no drains within the house, slop water being thrown on to the surface of the yard, or into some gutter or gully. Most houses abut on the street in front. At the back there is, exceptionally, a small patch of garden, but usually there is merely a yard common to several adjacent houses. Save for a breadth of a few feet of flagging or of brick pavement alongside the dwellings, these common yards are almost always unpaved, and not unfrequently their surface is very uneven. Each common yard contains a gully or gullies designed to take to the sewer both the slop water of the houses and the surface drainage of the common yard. These gullies are commonly efficiently trapped, although several provided with mason's traps are unsatisfactory. Open gutters which lead to these gullies are frequently defective and thus permit accumulations of slop water and surface water on the surface of the common yard. Besides middens, ashpits, and privies, to which I shall presently refer, the common yards frequently contain wash-houses, fowl-houses and other out-buildings. Here and there pigsties are met with in the common yard; swine kept 24 or more feet from dwellings do not contravene the existing byelaws.

The newer* houses show improvement in some respects. Most appear substantially built, although I was told of objections to several where the gable ends had been constructed with 4½-inch brickwork only. The larger number are provided with damp-proof courses. A small garden at the back is found more frequently than with older houses, and, as a rule, yards constructed for new premises are better paved and drained than old yards.

There is little overcrowding of dwellings on area. Formerly overcrowding of persons in dwellings was common, owing, in the main, to insufficiency of houses for the population; but now, it is said, overcrowding of persons in houses is less often met with.

Water Supply.—The water supply of the whole district is constant, and is derived from waterworks near Calverton, some six miles distant. The waterworks were constructed by the Local Board in 1880, and are now the property of the District Council. Water is pumped from two wells, each 125 feet deep, sunk into New Red Sandstone. The average water level of the wells lies 83 feet below the surface. The original works were enlarged and the wells deepened in 1887, when there was a deficiency of water, caused, it is said, by the construction by the Nottingham Corporation of other wells in the neigh-

* Here and elsewhere in this report, I apply for convenience the term "newer" only to the large number of houses built in Hucknall Torkard during the last ten years or thereabouts.

bourhood, which draw water from the same formation. Since 1887 there is said to have been no lack of water or failure at any time to keep up the constant supply.

Water is pumped to Hucknall Torkard in iron pipes. The inhabitants obtain their water by way of taps in the houses or of standpipes placed in the common yards. During pumping operations, the water not drawn off in the town passes into a reservoir at Wood Lane, on the west of the district, constructed nearly 100 feet above the highest point of the town. This reservoir, which is built of brick, is roofed and turfed over. It has a storage capacity of 500,000 gallons, estimated to be equal to three days' supply. Pumping from the waterworks takes place between 6 p.m. and 8 a.m., the water supplied to the town for the rest of the 24 hours coming from Wood Lane reservoir.

Sewerage.—The sewers of the older streets, which have been laid for many years, have several defects. The earthenware socket pipes of which they are constructed were originally provided with clay joints, which allow of leakage. Owing to the trouble involved in excavating the hard magnesian limestone on which the sewers rest they have often been laid with insufficient fall. Latterly, parts of these defective sewers have been relaid in more satisfactory fashion, while many new sewers of better construction have been connected with the older ones. As a result, however, there are to be found in the course of several of the sewers undesirable changes in calibre. Thus, in a principal street in the town, a sewer of 12-inches diameter is found leading to one 18 inches, only to contract, after a short distance, to 12 inches and, later, to 9 inches on its way to the outfall.

There are two distinct systems of sewers, one serving the northern and western, the other the southern and eastern parts of the town. The branch sewers of each system converge to a main sewer, which has in each instance been constructed with a diameter of 9 inches. The small size of this main sewer, and the changes of calibre in the course of branch sewers which lead to it, cause considerable obstruction to the flow of sewage through each system. In times of heavy rainfall the contents of sewers have been forced up into the roadway. Of recent years old and new sewers have been provided, at irregular intervals along the roadway, with manholes, which lead by vertical shafts directly to the crown of the sewer. At several places where the covers of these manholes were removed for my inspection, I noticed considerable silting in the sewer below. Flushing is performed by opening plugs in the street water mains, and letting a stream of water flow for some minutes into the street, and so to the sewer by way of the nearest gully in the roadway. In cases where I witnessed this proceeding, silted matter at the manhole next below the gully was not removed by the water thus directed into the sewer. As a rule this method of flushing is not available for the numerous "dead ends" of sewers. Little provision was originally made for sewer ventilation, and difficulty arose in consequence. Most of the manhole covers are now provided with ventilating grids, although the covers of manholes at the "dead ends" of some sewers are without ventilating opening. The manhole-cover grids of the pattern formerly adopted in the town are of reasonable size for the purpose in view, but the covers now in vogue, specially constructed to limit the grid openings to a few square inches, are less satisfactory. Rain water pipes from newer houses have in almost all cases been directly connected with the sewers in order to act as additional ventilators. Some of the rain water pipes thus connected to the sewers have their upper openings immediately under the upper windows of dwellings.

The two systems of sewers discharge to sewage works on the south-western side of the district. These works, which occupy four acres, were constructed in 1892 and have since undergone various alterations. Sewage is now treated with "alumino-ferric" cakes, then passes to precipitation tanks, and finally over beds of polarite and sand. The effluent passes to the River Lean. Owing mainly to the smallness of the two main sewers which convey sewage to the works, it has been necessary to construct overflows on certain sewers, so as to allow storm water and sewage to pass directly to the Lean. It is said that, even in comparatively dry weather, sewage passes directly into the river by means of these overflows.

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Excrement and Refuse Disposal.—Most premises in Hucknall Torkard are served by a privy midden, placed in the common yard to the rear of the dwellings. On several premises, some newer ones among the number, the privy midden is to be found within a few feet of the dwelling. There are usually two privies, one on each side of a midden, locally termed the "ashpit." Each of the newer houses, as a rule, has its own privy, but on older premises one privy is permitted to serve for the inhabitants of two, sometimes three, houses. The middens are uncovered and usually capacious. The brickwork of which they are constructed is not unfrequently dilapidated. The floor of the ashpit is sunk below the ground level, and neither floor nor walls are lined with cement or other impervious material; soakage of the wet contents of middens into the surrounding soil thus frequently occurs. I found the "ashpits" commonly overfull, the refuse they contained being piled up above the top of the brickwork, or spilled over on to the common yard. Up to the end of September last, the District Council employed a contractor to cleanse "ashpits." No regular visits to middens were made by the contractor, a given midden being cleansed only after the occupier of the premises had lodged a complaint with the Inspector of Nuisances, in order that the contractor might be instructed to visit. Since October 1st of this year the District Council has dispensed with a contractor and has itself undertaken the cleansing. All middens are cleansed at night. Many premises (including several of recent construction) have been so built that it is impossible to bring the night soil cart up to the midden. In these instances the contents of the midden have to be dug out and thrown on to the surface of the common yard, thence to be carried to the street in buckets. In this way much of the contents becomes spilled about the yard, or in the narrow passage by which access is commonly got to it from the street.

A few houses of the better class are provided with water closets. Within the last three years about 700 pail-, or "tub-," closets have been constructed in the district. About half this number serve new premises; the remainder have replaced faulty midden privies which the Sanitary Authority has required to be amended. These closets, as constructed and managed in Hucknall Torkard, are open to objection. Each is provided, usually by owner or occupier but now occasionally by the District Council, with a large movable pail made of galvanised iron or of wood. This pail is placed on a floor which is roughly paved with brick and not raised above the ground level. Thus overflow from the pail readily soaks into the soil beneath. The pails are reckoned to require emptying once a week. For the majority of premises supplied with pail closets, including most of the newer premises, no provision whatever has been made for the reception of dry refuse. Hence it happens that as much dry refuse as possible is disposed of in the closet pails, and the latter become full before the week is out. Some of the more careful householders meet the difficulty by providing an extra movable receptacle, but most are content to store all dry refuse, which cannot be accommodated in the closet pail, in some corner of their yard, or to make a refuse heap on any piece of waste land which is accessible. I saw several such heaps of refuse by the side of thoroughfares.

Premises with pail closets were formerly visited at night, once a week or less frequently, by the contractor. Now the same work is done by the scavengers of the District Council. The pails are taken from the privies, tipped into an open cart, and then replaced. No covers to the pails are used in the transport, and no attempt is made to clean either the pail or the floor of the privy. The pail closet system, as practised and encouraged in Hucknall Torkard, thus leads to considerable fouling of the soil in the neigbourhood of houses, not only from soakage through the floor of the privy, but also from spilling of the pail contents on to the surface of the common yard, which is liable to take place every week when overfull pails are carried about in the dark, and again from haphazard accumulations of refuse near houses occasioned by the want of proper receptacles.

Refuse and excrement from ashpits and pails have been disposed of by the contractor to farmers in the neighbourhood. The District Council are continuing this practice.

II.—ENTERIC FEVER.

Extent of Present Outbreak. — When I visited Hucknall Torkard on September 18th very little information was to be had of the extent of enteric fever prevalence in the town. The Medical Officer of Health had not long returned after an absence of some months on account of ill health, no deputy having in the meantime filled his office. The Infectious Disease (Notification) Act had been recently adopted in the district, and should have come into operation on September 1st. But no information was yet to be had from notifications, mainly because the medical practitioners concerned had not been informed by the Sanitary Authority of the necessity of notifying infectious diseases after September 1st, and for the reason that no forms had been sent to them for the purpose. In a report of the outbreak, which the Medical Officer of Health had presented to the District Council four days before my visit, he had estimated, chiefly from information obtained from the District Nursing Association, that 56 cases of enteric fever had occurred in the place since July 1st. But it speedily became evident that the actual number of persons attacked during this period had been considerably greater.

In response to my application, the various medical gentlemen in the district were so good as to inform me of all cases of enteric fever which had occurred in their practice since the beginning of the year. By September 22, I learnt, in this and other ways, of 109 cases. I made detailed inquiries as to several of these, and Mr. Jones, the Medical Officer of Health, subsequently obtained particulars of others. By October 15th, when I visited Hucknall Torkard again, 15 attacks of enteric fever had been reported in the interval; and from October 18th to the middle of November, Mr. Jones has informed me of the occurrence of 17 further cases. It appears, therefore, that from the beginning of this year to November 15th, 141 persons have been attacked with enteric fever in the place. Owing to removals from the district, and other causes, neither Mr. Jones nor I could obtain any information as regards 12 of these persons. Of the remaining 129, 74 were males and 55 females. They were thus distributed as regards age and fatal result:—

TABLE I.

——	All Ages.	0—	5—	10—	15—	20—	25—	35—	45 and upwards.
Cases - - -	129	3	17	18	22	17	27	13	12
Deaths - -	21	—	1	2	1	7	3	4	3

For many of these 129 sufferers by the fever, the date of onset of illness could not be determined with exactness. The number of persons attacked in each of the first five months of the year, and subsequently in each of a series of fortnightly periods, can however be stated with substantial accuracy. For the whole of Hucknall Torkard the corresponding numbers are given in the last column of Table II. on the next page.

Incidence and Distribution of the Fever.—In order to give a general idea of the incidence of the fever in one and another part of Hucknall Torkard, I have in Table II. recorded the cases which occurred in each of four divisions of the town. These divisions are respectively the central part of the town, the group of streets at its north-western end, that at its south-eastern end (Butlers Hill), and a fourth division lying to the south, consisting of a group of streets round Watnall Road. The divisions are arbitrary, but they represent fairly the four main groups of streets and houses which are obvious on inspection of a map of the district. The number of inhabited houses in each of the four divisions has been given me by the Assistant Overseer, who also assisted me in approximately estimating the population of each division. It will be seen that, while from the beginning of the epidemic, a number of persons have been attacked in each part of the town, yet the greatest incidence of the disease has throughout been on the Watnall Road division. Relatively to its estimated population, this division has sustained between four and five times as many fever attacks as the three other divisions taken together. In certain streets in the town the number of persons attacked had

been exceptionally great. Thus in one street of 61 houses (Truman Street, in the Watnall Road division) fever attacked no less than 23 persons living in 10 of the houses. In James Street (in the north-western division), comprising 50 houses, nine dwellings were invaded and ten persons were attacked. Other streets similarly affected were Curtis Street, Watnall Road, and Byron Street. Houses and premises in these streets did not differ in character from the older* houses and premises elsewhere in Hucknall Torkard, already described. Little fever occurred in newer streets or houses in any of the four divisions of the town. Both in streets where there had been few, and in those where there had been many attacks of fever, I found, as will be shown later, instances where a series of attacks had occurred among the inhabitants of certain adjacent houses, or of neighbouring houses opening to the same common yard. I also learnt of a number of houses in which more than one inmate had been attacked.

TABLE II.—Distribution of 129 Cases of Enteric Fever in four Divisions of Hucknall Torkard, 1896.

Division.	North-Western.	Butler's Hill.	Watnall Road.	Central.	Whole Town.
Number of inhabited houses -	816	643	684	864	3,007
Number of houses invaded by enteric fever - - -	17	13	48	8	86
Approximate population - -	4,080	3,200	3,420	4,300	15,000
Number of persons attacked by enteric fever during—					
January - - -	—	—	1	—	1
February - -	—	—	2	—	2
March - - -	—	—	—	—	—
April - - -	1	—	3	—	4
May - - - -	—	—	2	—	2
Fortnight to—					
June 14 - - -	1	1	1	1	4
„ 28 - - -	1	—	—	1	2
July 12 - - -	3	3	13	1	20
„ 26 - - -	—	1	5	4	10
August 9 - -	6	4	9	1	20
„ 23 - - -	4	1	9	—	14
September 6 - -	6	—	4	1	11
„ 20 - - -	2	2	9	—	13
October 4 - -	2	3	3	—	8
„ 18 - - -	—	—	2	—	2
October 19–November 15 -	1	5	9	1	16
January to November 15, 1896 -	27	20	72	10	129

None of the enteric fever patients had, I found, been treated in hospital. They had received medical attention at their homes, and had been visited, as much as circumstances permitted, by nurses of the Hucknall District Nurses' Association, who appear to have done good work throughout the epidemic.

As to Cause of the Fever.

In considering the question of the origin and spread of the epidemic, I had first to look for conditions which the different sufferers from the fever had in common.

Occupation.—As might have been anticipated from their distribution as regards age and sex, the persons attacked followed very varied occupations. There appeared to have been no exceptional incidence among those who worked at any one colliery or workshop. Nor could I hear of any one house or other place frequented by a considerable proportion of those attacked.

Food and Milk Supply.—The households invaded obtained their milk from no less than 20 milk vendors. Most of these vendors are also cow-keepers, the rest obtain milk from certain separate farms in the neighbourhood.

* *See* footnote to p. 2.

At the time of my visit it was only in the case of persons recently attacked by fever that I could obtain information as to other articles of food. The majority of these had not, as far as I could ascertain, consumed any one article of food in common.

Water Supply.—All the invaded houses were, like the rest of Hucknall Torkard, supplied with water from the town waterworks. The relation between the fever and water supply could only be studied in the town itself, there being no places outside to which public town water is delivered. Had the water supply been the infecting agent, it was to be expected, in the first place, that the houses invaded would have been found distributed throughout the town with some uniformity. As has been indicated, however, considerable parts of the town were very little affected. Several streets, for instance, had throughout been free from fever, while in neighbouring streets many cases had occurred. In the next place it was to be expected, on a theory of water-causation of the fever, that the newer houses and streets would have been invaded in approximately the same proportion as the older, whereas, in fact, the number of cases of fever which occurred in the newer streets and houses had been disproportionately few. Further, I did not obtain any facts which pointed to pollution of the public water supply. I saw no reason to question the purity of the water which feeds the two deep wells at Calverton. They are properly enclosed, and there was no sign of leakage of surface water into them. Except the resident engineer and his son, no one, it is stated, has this year been down the wells. There has been no recent illness at the house of the resident engineer, or at the only other dwelling which is near the pumping station. The reservoir at Wood Lane is situated at a level higher than the surrounding district, and is covered and locked. No cleaning or other work has been done at this reservoir during the year.

The District Council's "inspector of taps" informed me that some years ago leaks in the water mains, in their course through the Hucknall Torkard streets, were common. He has in the past detected water flowing from a leaky main straight into the faulty sewer by the side of which the main was laid. But he has for some years systematically looked for and remedied leakages. He claims to be an adept in detecting the escape of water from street mains by means of a water "telephone"—an instrument like a large stethoscope—with which he listens at night at various stand-pipes. It appeared from his books that no leak had been discovered during this year, by this instrument or otherwise, in any street water main in the district.

Sewerage.—The houses invaded were served by a number of different sewers, some belonging to one, and some to the other of the two distinct systems of sewers already described. Gullies draining the yards of premises invaded by fever were in some cases faultily trapped, in others their traps appeared efficient.

It thus appeared that the various sufferers by the fever for the most part had not been exposed to a common infection in any place of occupation, meeting, or the like; that at least a considerable number had no food or milk supply in common; that persons were attacked whose houses are served by each of two distinct systems of sewers, and that there was no evidence to connect the town water supply with the epidemic.

But the bearing of certain other features of the epidemic remained to be considered.

My attention was first directed to the exceptionally heavy incidence of the fever on certain streets and localities, and I made particular inquiry at these places. Even in those streets where the number of cases had been exceptionally large, the distribution of the invaded houses was, I found, by no means regular. Commonly, in such a street, the whole of the persons attacked would be found to live in a small number of houses, and those usually adjacent houses, or neighbouring dwellings opening to the same common yard. In individual houses, too, more than one case of fever had frequently occurred. Thus, among the 129 recorded cases 43 lived in houses in which an inmate or inmates had been attacked a fortnight or more previously. This occurrence of several cases in individual houses and in groups of houses was apparent in localities where there had been few as well as in those where there had been many attacks of fever. Further, it was only rarely that an exceptional

number of cases heard of in a particular street, group of houses, or house was composed of persons who had been attacked simultaneously. Usually where a plurality of attacks had occurred in a locality or house, the cases had followed one another at irregular intervals during a number of weeks or months.

These facts suggested that the epidemic had been augmented, in considerable measure, by local spread of infection from the person attacked to other persons brought into close relation with him or with the premises he occupied.

It was necessary to consider, therefore, what circumstances might have contributed to local spread of infection of this sort, and for what share of the epidemic such local spread might have been responsible.

On my second visit to Hucknall Torkard on October 15th, the Medical Officer of Health supplied me with a list of 15 cases of fever (occurring in 10 houses in different parts of the town), all of which had been for the first time reported to him since my previous visit. I made particular inquiries as to each of these 15 cases. The information which I obtained illustrates some of the conditions associated with local spread of infection of the kind referred to, and I therefore give a short account of them.

I.—Truman Street.—William M., carrier, aged 45, attacked September 7th.*
T. M., his son, 16, attacked September 5th.

II.—Truman Street.—Mrs. B., 30, attacked September 10th.
Jas. B., 3, A. S. B., 4, „ September 13th.

These five cases of fever were found to belong to an antecedent series which had occurred in two adjoining houses as follows:—

House I.—J. R., a carrier, attacked July 11th.

Two other members of J. R.'s family attacked at the end of July and in August respectively. The R. family left the house, and the district, on September 28th.

W. M. (attacked September 7th) and T. M. (attacked September 5th) had come to Hucknall from Nottingham in July to take over J. R.'s business. They now live in House I. Until J. R. left, they slept in a neighbouring house, where there had been no fever, but had meals in House I., and used R.'s premises and stable.

House II.—Emma B., 6, attacked August 14th.

These Truman Street houses were of the usual four-roomed type. House I. contained at the date of my visit eight of the M. family, House II., 10 of the B. family. A separate room had been given to the fever patients in each house, but undue crowding of the other inmates was thereby occasioned. Houses I. and II., with a third, House III., open in front to Truman Street, and behind to a small paved yard. At the end of this yard, some 15 feet from the dwellings, is an uncovered brick midden sunk below the ground level, with a privy on either side. The first privy serves House III. only, the second serves Houses I. and II. A dry ashpit, demolished a few days before my visit, was formerly situated a few yards from House I. Neither midden nor dry ashpit, I was informed, had been emptied more than once since the first case of fever occurred in these houses. There is a stable in the yard, provided with an open manure pit, built by the side of the dry ashpit.

None of the inhabitants of House II. were said to have visited or come into relation with inmates of House I. while fever prevailed there. Slops and urine, however, from cases of fever in each house were said to have been thrown into the gully which drains the yard, into the privy midden, or into the manure pit. Excreta from these cases were disposed of either in the privy common to Houses I. and II., or else directly into the associated midden. Latterly they had been thrown into the dry ashpit or the stable manure pit.

Thus, as regards the carrier M. and his son, not only had they for some weeks prior to their illness frequented a house where persons were ill with fever, but they had during the same period constantly worked in a yard in parts of which excreta and other matters from fever cases had been deposited day after day since July. In the case of the three members of the B. family recently attacked, there had been a similar use of the yard, which the children habitually played in; while each of the three had also come into close relation within the house with the sick child E. B., attacked on August 14th.

III.—Truman Street.—M. S., aged 11, attacked October 1st.
J. S., aged 12, „ October 4th.

These were two children of M. A. S., now convalescent from enteric fever, by which she was attacked on August 28th. Both children had attended to their mother while she was ill. The house was very dirty. Two small bedrooms serve for the ten persons who live in it. The house is one of four which open at the back to a common yard. There is faulty flagging, a few feet in breadth, alongside the four houses; elsewhere the common yard is unpaved. Slop water thrown into the defective gutters or on to the surface of the yard does not readily drain away. A capacious uncovered midden with attached privies, situated at the end of the yard, serves for the four houses.

Next door, J. H., 17, had been attacked on July 13th, and previously, at the end of June, J. P., 17, then living at a third house in the same yard, had also been attacked.

Excreta from all these enteric fever cases had been disposed of in the common midden, which was full when I saw it. Urine had been taken to the same midden, or had been thrown with other slop water into the defective gutters.

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* The dates of attack given in these notes are necessarily approximate.

The S. children attacked in October must needs have been particularly exposed to infection when they attended their mother under conditions of dirt and overcrowding. And all the four persons attacked subsequently to J. P. may be thought of as having been exposed to infection from matters, derived from fever patients, present in privies, midden, and common yard.

IV.—Byron Street.—Mrs. W., 27, attacked September 26th.

There had been no cases of fever in the other houses of the common yard which Mrs. W.'s house adjoins. It appeared, however, that Mrs. W., up to the time of her illness, had taken in the washing of the B. family in Truman Street (*see* II.), including that of the B. fever patients. Dirty linen was brought round to her house from the B.'s; the sheets usually had been soaked in some disinfecting solution, but handkerchiefs and towels arrived dry. The B.s were, indeed, said to have been particularly neglectful in their use of "disinfectants." Mrs. W. herself took back clean linen to the B.'s house, but says she never went in nor stayed there. I did not learn of any facts which assocated Mrs. W. with fever patients other than the B.s.

V.—Byron Street.—Mrs. H., 43, attacked October 1st.
J. H., 7, attacked October 8th.

There had been a previous case of fever in another house of the common yard which the H.'s house adjoins, M. B., 18, attacked August 1st, and convalescent only by the middle of September. No communication, such as visiting or nursing, was known to have taken place between M. B. and Mrs. H. or J. H. Excreta and urine in M. B.'s case had been disposed of in an open privy midden in the common yard. Midden and privies had been demolished on September 18th, and pail privies substituted. The demolition seems to have entailed scattering of the contents of the midden and privies over the surface of the unpaved yard close to the H.'s house.

VI.—Sylvester Street.—J. S., 25, attacked October 3rd.

J. S. lived in one of four houses which open to a common yard. In one of these, S. G., 43, had been attacked with fever on July 5th, and his wife, Mrs. G., 42, on August 12th. As in the last case, no direct association of the S. and G. families was heard of. Slops from G.'s house had been thrown into a gutter, or on to the surface of the yard, which is unpaved. Excreta from enteric fever cases at G.'s had been disposed of in pail closets of the yard, or into a dry ashpit. The pails were overfull when I saw them, and could hardly have been removed without spilling their contents on the yard or in the narrow passage which leads to it from the street. The dry ashpit also needed emptying.

VII.—James Street.—Mrs. C., 31, attacked September 26th.

Cases of fever had previously occurred in two adjoining houses as follows:—

House I.—Mrs. S., attacked July 8th.

House II.—A. C., aged 2, suffered from illness from the end of August, lasting five or six weeks. Illness not stated to have been enteric fever, but the child appears to have been feverish, had much constipation, and had wasted.

No communication, in the way of visiting or nursing, was reported to have taken place between those attacked in Houses I. and II. respectively. There are six houses opening to a common yard. In Houses III. to VI. there had been no fever. The common yard is unpaved and badly drained. Houses I. and II. have each a privy annexed to a common midden of the usual type. Excreta from the fever cases have been disposed of in the midden privies. Urine and liquid refuse have been thrown into the defective gutters or into the midden. The midden is said not to have been emptied for three months.

VIII.—George Street.—Mabel P., 8, attacked October 1st.

In this house, Mabel P.'s brother, Willie P., 7, had been attacked on August 18th. No other cases of fever were reported in other houses opening to the same common yard. Although Willie P. had been "isolated" in one room in the house, Mabel appears to have at times played in his bedroom during his illness. In this instance all excreta and urine from the fever cases were said to have been each day carefully buried in a tiny grass plot in front of the house.

IX.—Hankin Street.—W. P., 45, a miner, attacked October 1st.

W. P. works at a colliery where other cases have recently occurred, but I obtained no facts which connected his illness with these or with any other previous cases of fever. W. P. is the first person living in Hankin Street who has been attacked.

[I learn that by November 15th, three other persons in this street have been attacked, one of whom apparently lives next door to W. P.]

X.—Beardall Street.—Martha B., 27, attacked October 4th (died October 22nd).

Martha B.'s case appeared to be connected with a series of previous fever cases as follows:—

House in Quarry Street—E. H., aged 3, attacked June 13th.
J. H., „ 25, „ July 21st.
Mrs. H., „ 25, „ July 28th.

House in Beardall Street—Mrs. B., 48, Mrs. H.'s mother, attacked about August 10th. Illness not stated to have been enteric fever, but she seems to have had diarrhœa, headache, loss of flesh, and fever which kept her in bed for three weeks.
Joseph B., aged 22, attacked September 7th, died Septembe 26th.

The most obvious connexion which these cases had one with another was in nursing and attendance. Both Mrs. H. and J. H. tended their sick child, E. H.; and Mrs. B. for some weeks prior to her illness had been nursing the sick inmates of H.'s household, spending the greater

part of her day there. Occasionally she had meals at the H.'s house. When Joseph B. was ill, Martha B. assisted her mother in looking after him. As regards other conditions, I noted that the H.'s house in Quarry Street was old and damp, that the unpaved yard was faultily levelled and that the privies and middens which received excreta from the fever cases had the objectionable characters usual in the district. B.'s house in Beardall Street is of better class, and has its own garden, in which excreta and urine from Joseph and Martha B. were disposed of. At the time of Mrs. B.'s illness, however, no precautions of this kind were taken, excreta being thrown into a pail closet used by all the rest of the household.

As a result of these inquiries it would seem that almost every one of these 15 persons recently attacked had, apparently, been exposed locally to diverse opportunities of infection. Now, given—to take the common case—a series of attacks of fever among a number of inmates of a house, or among those of several houses which adjoin a common yard, all the fever cases being treated at home, often under conditions of undue crowding, and frequently also of dirt; given also that the common yard is unpaved and badly drained, and so is liable to pollution from waste water of houses and soakage from middens; that the middens or pail closets, at the best of times imperfectly cleaned, are commonly allowed to become over full; and given further that yard, midden, and closet pails continue to receive infectious matter from enteric fever cases for many weeks or months, it must needs be a hopeless task to determine the exact way in which any one member of the series contracted his or her fever. There were no facts, for instance, which indicated whether the infection of a particular case arose within the house from what, for want of a better term, I may call the accidents of association with a previous fever case or cases;* whether from importation into the house of infectious soil from the yard; from visits to polluted midden or privy; from inhalation of infectious particles blown in the form of dust about the yard or into the house, or from other sources. This question, therefore, I had to leave unsolved.

But the bearing of the facts obtained with regard to these 15 cases upon the question of the causation of the epidemic as a whole had to be further considered. Did the whole epidemic represent a succession of attacks of fever, in which each person attacked had been exposed to localized conditions favouring transmission to him of infection from previous, but not long antecedent, fever case or cases—conditions, in fact, similar to those found in the majority of the 15 attacks which were specially inquired into? Or, on the other hand, was it that the bulk of the sufferers by the epidemic had been in common exposed to some single source of infection—as, for instance, food, milk, water—and that the later attacks inquired into were merely instances of a lingering of the fever, under exceptional circumstances, after the main cause of the outbreak had ceased to be operative?

Now, in the first place, the occurrence of local series of cases among the inhabitants of certain houses and groups of houses, observed in connexion with the 15 recent attacks inquired into, had not been exceptional in the epidemic. Similar local series of cases were to be heard of as having occurred in different parts of Hucknall Torkard ever since fever began this year to be prevalent. And in the next place, the unwholesome conditions which I have described as favouring the local spread of the disease in the cases which I inquired into were not exceptional conditions. Thus the character of premises, yards, middens, and privies, the circumstances of intercourse of healthy with sick, the occasional overcrowding, and the like, obvious in the cases I have noted, were all to be found as abundantly elsewhere in the district. It appeared, indeed, that the instances of local spread of the disease, of the kind referred to, had been so numerous that a hypothesis that some single infecting agent, such as infected water, milk, or food, had been operative was not needed to account for the illness of a large number, or even of a majority of the sufferers from the epidemic. Whether or no such single infecting agent was operative in producing a proportion of attacks, particularly among persons whose illness was the first of a local series of cases, the facts at my disposal are not sufficient to indicate.

But it may be observed that a case of fever which occurs in a house under unwholesome conditions such as I have described as common in Hucknall Torkard, is not to be regarded as capable of infecting only those persons who

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* Such an infection, for instance (whatever its exact nature may be), as is occasionally met with in the case of nurses tending enteric fever cases in hospital, and is likely to have been more potent in Hucknall Torkard houses.

live in the same house or its immediate neighbourhood. In one of the cases I inquired into, for instance (that of Mrs. W., No. IV.), it seemed probable that infection had been carried to a distance by means of soiled linen used by an enteric fever patient; in at least one other (Mrs. B., No. X.) it seemed that a person who had constantly visited fever patients in another street had there contracted the disease, and that her illness was the immediate cause of the series of cases which subsequently occurred in her own household. So, although I did not trace any instance in this outbreak, it seemed that a local series of cases may have been started in particular localities by the illness of children, who habitually used, as playgrounds, yards in which infectious matters from fever cases were deposited, and were themselves likely to be attacked by a slight or unrecognised form of the disease.

Suspicions of infection, carried from one place to another, by means of dust derived from middens, from drying of refuse and excrement spilled from privy pails, from the open carts used for removing the contents of middens and privies, or the like, could not, under the present sanitary conditions of Hucknall Torkard, be ignored.

It will be noted that the unwholesome conditions which I have described as associated with the spread of fever during this year in Hucknall Torkard are conditions which are common in the town, and which have probably been equally common in past years. Now, in each year, from 1883 to 1895,* it appears by the returns of mortality, that some enteric fever occurred in the town, but that in no one of these years was its incidence exceptionally heavy. Whether the ability of the common unwholesome conditions to spread fever has differed in some way in 1896 from their ability so to spread it in previous years, or whether the present heavy incidence of fever is related to a particular method of dissemination of the disease in the earlier months of the year, not obvious at the time of my inquiry, or whether again, the difference has been determined by an exceptional virulence of the infecting agent, I am unable to indicate. But it is obvious that so long as these unwholesome conditions are common in Hucknall Torkard, a repetition in any future year of the town's experience of enteric fever in 1896 can hardly be a matter for surprise.

III.—Sanitary Administration.

The Urban District Council of Hucknall Torkard consists of 18 members, half of whom form a Sanitary Committee. The Council and the Sanitary Committee usually meet fortnightly. The clerk is Mr. P. Woodward, who lives in Nottingham.

The post of *Medical Officer of Health* is held by Mr. Hugh Thomas Jones, M.R.C.S., L.R.C.P., who receives a salary of 40*l*., half of which is repaid from county funds. This officer makes periodical inspections of his district, and reports monthly and annually to his Authority.

The post of *Inspector of Nuisances* is filled by Mr. D. Swann, who receives a salary of 80*l*., half of which is similarly repaid. Mr. Swann is also *Surveyor* and *Superintendent of Waterworks*, for which he is paid 70*l*. per annum.

The duties entailed on Mr. Swann by these different offices are altogether too many. Those of the surveyor alone, which at the present time particularly demand thorough supervision of the construction of several new streets and buildings, efficient dealing with the difficulties of sewerage already indicated, and many other matters, need for their proper performance the whole of that

* The following have been the number of deaths from enteric fever certified in Hucknall Torkard for each year since 1875:—

Year.	No.	Year.	No.	Year.	No.
1880	2	1886	2	1892	2
1881	11	1887	3	1893	3
1882	—	1888	1	1894	2
1883	2	1889	1	1895	2
1884	2	1890	1	1896	21
1885	4	1891	1		

officer's time. Similarly there can be no doubt that, in view of the population of Hucknall Torkard and of its sanitary shortcomings, the duties of an Inspector of Nuisances are more than enough to occupy the whole time of a competent officer. As matters stand, almost all parts of Mr. Swann's work suffer. Thus I had sufficient evidence that alterations in building plans submitted to the surveyor, although frequently desirable, had only rarely been required by him, and that he has, after approving plans for new buildings, usually been unable to give adequate supervision to their construction.

Again, with regard to nuisances, even such time as Mr. Swann gives to the work is often wasted. On inspection of a number of premises where this officer had given notice to abate nuisances, the time allowed in the notice having in each case expired, I found that in a majority of instances nothing had been done. Sometimes the work specified by the notice was altogether inadequate to abate the nuisance in question. As example, a defective gully, placed in an unpaved and uneven yard in such a position that it could not drain surface water, had been required by this officer's notice to be replaced by a trapped gully in the same useless position. So, too, in a large number of cases he has given notice to owners to replace midden privies by pail closets, without requiring any provision for disposal of dry refuse to be made.

Besides the officers I have mentioned, the Council employs a clerk to Mr. Swann, an inspector and an engineer of waterworks, and men for road scavenging and night-soil work.

The Urban District Council began its work, in succession to a Local Board, at the end of 1894, shortly after Dr. Horne had reported to the Board upon the sanitary administration of the district. In reviewing the Council's work since its formation, it will be well to set out some of the chief needs of the district which Dr. Horne pointed out :—

1894.	1896.
"The Infectious Disease (Notification) Act, 1889, has not been adopted in the district."	Infectious Disease (Notification) Act just adopted in the district, too late to have been of use in connexion with the present epidemic.
"Neither have any parts of the Infectious Disease (Prevention) Act, 1890, or the Public Health Acts Amendment Act, 1890. That . . . the first and parts of the two latter of these Acts would be of service in the district, there can be no doubt."	No parts of Infectious Disease (Prevention) Act, 1890, or of the Public Health Acts Amendment Act, adopted.
. . . "Neither could benefit fail to accrue from a revision of the existing obsolete byelaws."	Obsolete byelaws are still in force. Fresh byelaws for new streets and buildings, slaughter-houses, and nuisances, framed on the Board's model, have now been resolved on by the Council. An earlier adoption and enforcement of these new byelaws would have prevented much that is unsatisfactory in the numerous buildings constructed in the last two years.
"The district is destitute of provision for the isolation of cases of infectious disease."	The district is still destitute of provision for the isolation of cases of infectious disease.

Dr. Horne further pointed to the need for better scavenging of privies and "ashpits," for the paving and drainage of yards, and for thorough action in repressing nuisances, in none of which directions does the District Council seem to have made any noteworthy improvement. With regard to midden privies, the Authority has, it is true, caused a number of these to be replaced by pail-closets, but owing to the manner in which this has been carried out, and to the insufficiency of the corresponding arrangements for scavenging, it is doubtful whether any sanitary advantage has been gained for the place.

Procedure of the District Council in repression of the Epidemic.

There is little to chronicle under this head. As has been said, no hospital was available for enteric fever patients. On my first visit to Hucknall Torkard, on September 18th, I found that little more than half the cases of enteric fever were known to the officers of the Council. The Medical Officer of Health, on returning after his illness, had visited certain of the invaded houses and given counsel to the inmates with regard to the disposal of excreta, and as to other matters. The Inspector of Nuisances had also visited certain invaded houses, leaving some disinfecting powder (with oral instructions as to its use), and in certain cases had given notice for the abatement of nuisances found on the premises. It did not seem that further visits had been paid to these houses by either of these officers to see that the instructions given were carried out. The inmates had permission to send to the District Council's offices for more disinfecting powder if they required it, and they fully availed themselves of this privilege. But the unwholesome conditions of the invaded premises were not of a kind which disinfecting powder could correct, even had its use been judiciously supervised.

No special arrangements had been made for systematically dealing with excreta or other infected matters in regard of dwellings known by the Authority to be invaded, or even for more frequent cleansing of the midden or privy pails which served such premises.

Disinfection of the invaded premises was not attempted at any time during the epidemic, nor was the hot air disinfector possessed by the Authority utilised for dealing with bedding, clothing, or other articles used by the enteric fever patients.

With reference to nuisances throughout the town generally, a man had been appointed during the epidemic to assist the Inspector of Nuisances in visiting middens and pail closets, and in reporting to the contractor those which were most in need of cleansing. But this arrangement had been manifestly insufficient to meet the needs of the case.

I attended a meeting of the Sanitary Committee on September 21st, and pointed out some of the duties which devolved upon the District Council in repression of the epidemic. On again visiting the town on October 15th, I found that the Medical Officer of Health was now informed, by notification, of cases of infectious sickness in the district, and that he had made local inquiries into all recent attacks. Covered galvanized iron pails for the reception of excreta and other infectious matter had been supplied to most of the houses where fever still prevailed, and these were professedly emptied daily by scavengers of the District Council. I learnt, however, that they were not emptied on Sundays, and that the emptying merely consisted in taking the pail to a cart in the street, tipping its contents into a larger pail in the cart, putting disinfecting powder over what matters remained in the first-named pail, and then returning that pail to the premises—a good illustration of the imperfect methods that seem to be current in Hucknall Torkard. More attention, I was told, was being given to cleansing middens and closet pails now that the cleansing had ceased to be done by contract. The change was too recent, however, to enable me to judge whether improvement had resulted. The staff of men, and the horses and carts employed by the District Council, were said not to materially exceed in number those formerly employed by the contractor.

It is to be hoped that the inhabitants of Hucknall Torkard—and particularly those responsible for its sanitary administration—will take pains to understand the principal lessons of the epidemic.

One of the most important is the necessity for hospital accommodation for persons attacked by infectious disease in the district. The facts which I obtained with regard to the present epidemic suffice to indicate that, had the earlier cases of fever which occurred in the town been promptly removed to a suitable hospital, the amount of illness caused by the epidemic might have been rendered conspicuously less. The number of deaths from the fever, too, would almost certainly have been smaller, not only because fewer persons would have been attacked, but also because persons of the class affected by enteric fever in this outbreak necessarily obtain far more satisfactory treatment in a properly administered hospital than they can receive at their homes.

A hospital for infectious diseases would have been available had the District Council paid attention to the many representations on the subject which have been made by the Board, to the annual reports of the Medical Officer of Health, or to the teaching of recent epidemics in the district. Thus the need for a hospital was abundantly shown when small-pox occurred in the town in 1893, and when scarlatina was epidemic in 1894. On each occasion, however, the Authority, though moved to institute inquiries as to hospital provision, abandoned them when the disease became less prevalent.

I am informed that, since my visit, the District Council has instituted a correspondence with certain neighbouring authorities with a view to joint provision of a hospital for infectious diseases. The question of combination of districts in the neighbourhood of Hucknall Torkard for hospital purposes deserves serious consideration. But it is to be hoped that the Hucknall District Council will now take up the question in a more determined spirit than heretofore, and will make every effort to obtain a hospital without further delay, whether by independent action or by action in combination with some other authority or authorities.

In the next place the facts of the epidemic indicate unmistakeably that sustained progress in sanitary matters is badly needed in Hucknall Torkard. The various unwholesome conditions to which I have pointed as associated with the fever are essentially conditions which it was the duty of the Sanitary Authority to have prevented. If the District Council is now to be mindful of its responsibilities with regard to the public health of the district, it must first look to these conditions in detail. In particular, the Council will do well to give attention to faulty premises. It is desirable that steps should be taken to secure the proper paving and drainage of common yards, and to get rid of unwholesome middens and privies. In dealing with these and other matters in connection with older premises the District Council will find the work facilitated by sections of the Public Health Acts Amendment Act, which it has already been advised to adopt. It is desirable that overcrowding in dwellings should be looked for and remedied. With regard to unwholesome privy middens, the District Council will do well to remember that the recent substitutions of pail closets for middens has not been carried out in a satisfactory way, and that if the substitution of pail closets for midden privies is continued, it is particularly desirable that the new closets be properly constructed, in a form, for instance, such as that contemplated in the Board's Model Byelaws; that in all new buildings, and as far as possible on old premises also, secondary means of access to such closets are provided, so that scavengers are not obliged to carry pails across common yards and through the narrow passages which the inhabitants commonly traverse; that provision should be made for the proper cleansing of pails removed or for replacing them by clean pails; and that suitable receptacles for dry refuse be provided wherever a pail closet is substituted for a midden privy. The District Council ought further to see that the emptying of all such receptacles, pail closets, and middens, is performed with proper regularity and frequency. In view of the opportunities of spilling the contents of privy pails in the neighbourhood of dwellings, it will be found more satisfactory to remove privy pails and dry refuse by daylight.

It is desirable that the sewers should be systematically looked to, with the object of removing obstructions to the flow of sewage in them, and of remedying other defects which I have described. And, seeing that considerable alterations in the sewerage system are likely to be found necessary, the Council may advantageously consider the question of so constructing or re-constructing sewers as to permit a watercloset system to supersede the "dry" method of excrement disposal which has been maintained in the place.

If the District Council is to take proper action in these matters, it appears essential that it should be kept fully informed of the day to day requirements of the district. I have sufficiently indicated that the present Inspector of Nuisances does not, and cannot, properly perform his multiple duties. It is on every ground desirable that a skilled inspector should give his whole time to the duties of the office. To secure such service, the District Council would have, of course, to offer a salary higher than is at

present paid. But in view of the incomplete, and consequently often wasteful, character of the sanitary work performed in the district, there can be little doubt that the extra expense involved in an appointment such as I am now urging would be more than repaid.

G. S. BUCHANAN.

December 1896.

RECOMMENDATIONS.

1. The District Council should, without further delay, provide, either by themselves or in combination with a neighbouring authority or authorities, adequate hospital accommodation for cases of infectious disease arising in their district.

2. The District Council should give thorough and systematic attention to insanitary premises in the district, and should exercise the various powers which they possess or can obtain to remedy defects in detail. In particular they should proceed to deal effectively with—

(*a.*) Premises with drains faultily constructed ;

(*b.*) Unpaved or insufficiently paved yards ;

(*c.*) Receptacles for excrement and refuse improperly situated or constructed.

3. The District Council should see that a thorough and satisfactory system of periodical removal of excrement and refuse from the premises of the district is established at the earliest practicable date.

4. The District Council should forthwith secure the whole time service of a trained and competent Inspector of Nuisances.
